

REMARKS

Claims 1-2, 4-12, 14, 17, 18, and 29, 30 are pending in the present application.

Reconsideration and allowance of the pending claims is respectfully requested.

35 U.S.C. § 103, OBVIOUSNESS

The Examiner has rejected claims 1-2, 4-9, 11-12, 14, 17, and 29 under 35 U.S.C. § 103 (a) as being unpatentable over Prior Art (PA, submitted by applicant) in view of Polcyn (U.S. Patent No. 4,395,585). The foregoing rejections are respectfully traversed for the reasons discussed below.

With regard to claims 1, 4-9, 11-12, and 29, the Office Action states:

As to claims 1, 4-6, 8, 29, PA discloses a power module (100) and a method as shown in figures 1-4 comprising:

A FR4 board (110) formed from a plurality of layers (claims 4-6) having at least one element, which is a pair of planar magnetic cores (130, claim 8), mounted thereon; and

At least one or three interconnects (solder balls 240-figure 4) for electrically coupling the element to an end user's circuit card (10-figure 4).

PA does not teach the interconnects having U-shaped including a sidewall and a contact surface, the contact surface includes a through hole, the through hole adapted to allow solder paste to flow into the interconnects to form a strong physical bond between the element and the end user's circuit card.

Polcyn shows a spacer (8, column 2, line 29) capable of being an interconnect, the interconnect being formed U-shaped (see figures 3-4) having a sidewall (28; 30; 32; 34, and column 2, lines 40-41) and a contact surface (10, column 2, line 30), the contact surface includes a through hole (12, column 2, line 31) disclosed in figures 1-5.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a structure of the interconnect having a U-shape as taught by Polcyn to employ the power module and method of PA in order to provide a table against vibrating or other undesired movement of one board mounted to another board.

The Examiner uses the Polcyn reference to reject independent Claims 1, 14, and 29. Claim 1 is reproduced for discussion:

1. (Previously Presented) A power module comprising:
 - (a) a board having at least one element mounted thereon; and
 - (b) at least one interconnect for electrically coupling the element to an end user's circuit card, wherein the interconnect is U-shaped, the interconnect further comprising a contact surface

having a through hole, said through hole adapted to allow solder paste to flow into the interconnect to form a strong physical bond between the element and the end user's circuit card.

Claim 1, as well as the other independent claims, claim an "interconnect" in some way, which is used to electrically couple an electrical element to a circuit card, for example. The Examiner points to Polcyn element 8, characterizing this part as an "interconnect." However, Polcyn clearly states that element 8 is a mounting support or spacer and is not an electrical interconnect. For example, Polcyn states at col. 1, lines 40-46:

Accordingly it is an object of the present invention to provide a new and improved component spacer.

It is a further object of the present invention to provide a new and improved component spacer which exerts pressure on the leads of the component to which it is applied so that the spacer is retained by the component leads during handling.

Furthermore, in col. 3, lines 37-40, Polcyn clearly states that the spacer 8 is made from an electrically insulating material. An electrical interconnect cannot be made from insulating, nonconductive materials. Hence, it is respectfully asserted that Polcyn's element 8 is not an "interconnect for electrically coupling...", as claimed in at least Claims 1, 14, and 29.

The Examiner also characterizes support element 8 of Polcyn as being "U-shaped." However, Polcyn's support element 8 is actually not U-shaped, but has four "feet" 28, 30, 32, and 34 on its base, making the element more H-shaped than U-shaped.

Having feet on the spacer 8 of Polcyn creates several performance differences between Polcyn's element 8 and the electrical interconnect of the present application. For example, the U-shaped pin design of the present electrical interconnect maximizes contact area, as the entire bottom of the interconnect structure makes contact with the circuit board, for example. By contrast, Polcyn's support element 8 only makes contact (and not electrical contact) on the bottom surfaces of the four feet--a significantly smaller surface area. In addition, col. 2, lines 43-46 of Polcyn states:

The feet 28, 30, 32 and 34, which can be seen in FIG. 4, elevate the spacer 8 above a printed circuit board so that solder joints, terminals, etc. are accessible thereunder.

Thus, the spacer element 8 taught by Polcyn secures electrical leads and accommodates access to solder joints but does not provide an electrical contact itself.

The U-shape design with through hole of the present interconnect element also enhances solderability. The through hole provides a path for solder to wick through and for the solder to outgas during a reflow process. On the H-shaped device of Polcyn, the hole or slots would be elevated off the board surface (because of the four feet) and would not serve this purpose.

The Examiner rejects Claim 29 for the same reasons as Claim 1. However, Claims 1 and 29 have different limitations, and it is respectfully asserted that the reasoning for rejecting Claim 1 is not adequate to reject Claim 29. Claim 29 follows:

29. (Original) A method of coupling a power module to an end-user circuit board comprising the steps of:

- (a) applying a solder paste to at least three mounting pads on said circuit board;
- (b) placing a power module having at least three interconnects onto the circuit board so that the interconnects contact to solder paste; wherein the solder paste flows through holes in the interconnects; and wherein a tolerance between the interconnects is absorbed in the solder paste; and
- (c) heating the solder paste.

This claim includes limitations not recited in Claim 1, such as the steps of “applying a solder paste to at least three mounting pads on said circuit board;” “wherein the solder paste flows through holes in the interconnects;” and “wherein a tolerance between the interconnects is absorbed in the solder paste.” Since these features of Claim 29 are not present in Claim 1 or in the cited references, it is respectfully believed that the rejection of Claim 29 fails to make out a *prima facie* case of obviousness.

On page 3 of the Office Action, Examiner states,

Regarding claims 2, 14, and 17, Polcyn shows the interconnect (8) made by conductive material (electrical insulative material, column 3, lines 38-40).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a conductive interconnect as taught by Polcyn to employ the interconnect of PA in order to make electrical connection between boards.

As pointed out above (and included in the Examiner's parentheses), the spacer taught in Polcyn is made from an insulating material. An insulating material does not conduct electricity.

Since claims 7, 9, 11, and 12 depend from claim 1, the same distinctions between claim 1 and Polcyn apply to the dependent claims as well.

The Examiner has also rejected claims 10 and 20 as being unpatentable over PA in view of Polcyn, and further in view of Hayashi et al. (US Patent No. 5,969,952). This rejection is also respectfully traversed.

It is respectfully asserted that the Polcyn and Hayashi references are not properly combinable in this way. Polcyn shows a nonconductive spacer-element, wherein the slots 17, 20 and aperture 12 are designed to accept electrical leads for connecting an electrical element to a circuit board, as stated in col. 2, lines 61-68. Since Polcyn specifically states a nonconductive material is to be used, this teaches away from the combination of Polcyn and Hayashi proposed by the Examiner. Making the spacer element 8 of Polcyn conductive would also destroy the intended purpose of Polcyn, since if spacer 8 were made conductive, it would mean the circuit board and electrical component of Polcyn would be in electrical contact at locations that were intended to be insulated by the spacer element 8. Hence, the nonconductive nature of Polcyn's spacer element 8 teaches away from the combination proposed by the Examiner. A *prima facie* case of obviousness cannot be properly based upon a prior art reference if the prior art reference requires some modification in order to be properly combined with another reference and such a modification destroys the intended purpose or function of the disclosed invention in the reference.

The Examiner has also rejected claim 18 as being unpatentable over PA in view of Polcyn, and further in view of Schneider et al. (US Patent No. 4,362,904).

The Examiner asserts that the teachings of Schneider could be employed with PA and Polcyn for the purpose of minimizing space between the first and second sidewalls to within 2 mils of each other. However, Schneider, like Polcyn, specifically teaches a spacer that is made from non-conducting material. Therefore, even if Schneider was combined with PA and Polcyn, the resulting combination still would not teach the interconnect as taught by claim 14, from which claim 18 depends.

All claims are believed to be distinguished from the cited references. Favorable reconsideration of the claims is respectfully requested.

CONCLUSION

It is respectfully urged that the subject application is patentable over the cited references and is now in condition for allowance.

The examiner is invited to call the undersigned at the below-listed telephone number if in the opinion of the examiner such a telephone conference would expedite or aid the prosecution and examination of this application.

DATE: November 3, 2003

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'David W. Carstens', written over a horizontal line.

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